

Mandals

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DIRECTION FOR USE
FOR THE

M A R N A

24/32HP. PETROL ENGINE.

4 CYL. TYPE FF

ENGLISH TRANSLATION.

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D I M E N S I O N E D S K E T C H .

Refer original Direction for use.

The relative positions of the bearing plates, and the centre line of the engine are clearly indicated in the sketch, - the rear plates being at the same height as the centre line, while the front plates lie 35 m/m ($1.3/8''$) below it.

The foundation beams, upon which the engine is mounted, must be cut away at a slant, between the front and rear bearing plates, inwards towards the engine, as is shown in the cross section: a - b, in order to facilitate admittance to the crankcase side hatches, which are placed as low as possible for the convenient withdrawal of the crank pin bearings, and also for the cleaning of the oil strainer, which is situated in the sump.

E N G I N E D I A G R A M .

Refer original Direction for use.

n - Revolutions per minute.

N - Effective Capacity in Horse Power.

The diagram shows the maximum capacity of the engine at various revolutions.

N_1 - The curve indicates the progressive capacity of an engine trimmed for pleasure boating, suitable for up to 1500 RPM.

N_2 - The curve indicates the progressive capacity of an engine trimmed for a heavy working boat (particularly a dorry) suitable for up to 1000 - 1200 RPM.

Maximum Turning Moment - 17 kg/m at 1000 RPM.

All engines are thoroughly tested prior to despatch, but a running in period must elapse before maximum capacity is attained. Therefore we make a reservation of 10 % tolerance at the most, on the results obtained from this diagram, when the engine is delivered.

DESCRIPTION OF THE MARNA 4 CYL.

24 - 32 H P.

CAPACITY: 24 - 32 HP.

NORMAL NUMBER OF REVOLUTIONS: 1000 - 1500 RPM.

MAX. TURNING MOMENT: 17 kg/m at 1000 RPM.

BORE: 95 m/m. STROKE: 110 m/m. PISTON DISPLACEMENT: 3117 cm³.

WEIGHT: Engine equipped with Clutch, Reverse, Rear Overhead Starting Assembly and Variable Pitch Propellor: approx. 315 kg.

Engine equipped with Gear, Rear Overhead Starting Assembly and Fixed Propellor: approx. 345 kg.

CYLINDER HEAD: Removable.

CYLINDER BLOCK: Cast in one piece and divided at the upper edge of the Crankcase, so that if a Cylinder Block is required as a spare part it can be supplied at approx. half the price of a block in which half the Crankcase and Cylinder are cast in one section.

PISTONS: The standard type of piston is cast of the highest quality cast iron, with chrome nickel alloy, but light-weight aluminium alloyed pistons can be supplied if specially ordered. The pistons are of a balanced weight, so as to achieve the least possible vibration.

LUBRICATION: The oil is pumped from the Crankcase oil sump and distributed to the various lubricating points by means of a gear type pump, and as the engine is constructed to be as oil tight as possible all oil returns to the sump. The consumption of lubrication oil is thus reduced to the attainable minimum, and an additional advantage with this type of lubrication system is that the interior of the boat is not soiled by waste oil. The oil pressure can be checked by means of a visual pressure gauge (manometer), and a dipstick type of oil capacity gauge is situated on one side of the engine to facilitate the checking of the oil level in the reservoir. The latter contains an oil filter, which is easily removable for cleaning purposes.

IGNITION: Bosch High Tension Magneto, with impulse Coupling.

CARBURETTOR: The carburettor is provided with a petrol filter, and does not require regulating for normal running. An extra filter is supplied for fitting to the petrol supply pipe.

THE GEAR: The Gear for forward, neutral, and reverse running is provided with a bevel gear which operates in oil, and the whole assembly has a smooth and quiet action. The engine can be supplied with a Clutch Assembly only, suitable for a variable pitch propellor and reverse apparatus. This is usually employed in a net fishing boat.

PROPELLOR EQUIPMENT: This can be supplied either with a variable pitch two-bladed propellor, diam. 455 m/m, shaft of 1" nickel-brassbolt and tube of 1.1/4" Yellow Metal, or with a fixed three-bladed propellor, diam. 430 m/m, shaft of 1" stainless steel or 1.1/4" Yellow Metal.

CONNECTING RODS: Of swaged steel in Double T-form, which affords the maximum security against fractures. The Crankshaft bearings are of specially alloyed White Metal, with a diameter of 2", and 42 m/m long.

CRANKSHAFT: Is forged of the highest quality steel, and strongly dimensioned, with 2" diameter bearings, which have a combined length of 200 m/m.

CAMSHAFT: Of tempered nickel steel, and ground overall. The cam and shaft are integral, and the three bearings are 1.5/16" - 1.5/8" and 1.5/16" respectively, with a combined length of 186 m/m. - The timing chain is a first class, adjustable, roller Triplex type, with a very smooth operation.

VALVES: Of Chrome Nickel steel, and the linings are easily removable. The valve seats lie flush with the top of the Cylinder Block, afford adequate cooling, and allow easy grinding in of the valves. The valve lifters are adjustable.

WATER PUMP: This is a gear type pump with a helical milled gear, and it supplies an adequate supply of water. It is completely noiseless in operation, and is provided with a safety coupling device, which operates in the event of the pump being frozen. - Inspection covers are situated on each side of the Crankcase and in front of the valve chamber on the cylinder, and are easy to remove and replace.

The "MARNA" 24-32 HP. engine, type FF, is normally delivered with one of the following equipments:

EQUIPMENT G: Variable Pitch Propellor, Clutch and Rear Overhead Starting Crank.

EQUIPMENT D: Fixed Propellor, Gear, and Rear Overhead Starting Crank.

The engine can also be despatched with a 12 Volt Dynamo, 12 Volt Starter and Dynamo, and (or) 100 l/min. Bilge Pump.

The engine is constructed so that it is delivered with a Rear Overhead Starting Crank, whether an Electric Starter is desired or not.

I N S T A L L A T I O N .

Refer original Direction for use.

Correct and accurate installation is the first requirement for the satisfactory performance of a marine engine, as faulty and inefficient mounting can cause overheating, serious abrasion, loss of power, and excessive vibration, etc.

THE FOUNDATION. The wooden foundation for the engine must be of first class material, preferably of oak, and it should consist of two beams, of a minimum thickness of 3". These should be firmly fastened longitudinally in the boat so as to avoid undue vibration, and when in position their height above the thwarts should not exceed 2.1/2".

Careful attention to fitting the foundation will pay good dividends.

In most cases the Reversing Apparatus can be mounted on the engine foundation, and therefore the latter should be a proportionate length, while ensuring that there is sufficient clearance at the fore edges for the Flywheel. (Refer to the diagram, which gives dimensional and positional details for correct mounting.)

Before the engine is bolted down, it is essential to ensure that the axis of the engine and propeller shafts are in alignment, and this should be done as follows:

The couplings of the two shafts should be fitted flush into other, and the propeller shaft turned by hand, then, if correct alignment has been attained, there will be no visible opening between the couplings. The engine can be finally bolted down, on completion of this test, although it will be necessary to check the alignment of the shafts again, after the engine is in position, and the couplings must therefore be slackened for this purpose.

EXAMINATION OF THE FOUNDATION. After a period of time, the engine and propeller shaft couplings must be slackened yet again, in order that the continued accuracy of the shaft alignment can be checked. This is necessary as the foundation beams have a tendency to warp when waterlogged.

When mounting the engine ensure that the Flywheel is fastened securely to it's shaft.

Normal Boat	Propeller shaft	2,5 m.	Tube	0,65 m.
Light Boat (for net fishing)	"	"	"	0,65 m.
Net Fishing Boat	"	"	"	0,65 m.

The "MARNA" 24-32 HP. Engine Type FF is equipped with a turn cock, fitted to the Cylinder Head, so that the warm water discharged from the Cooling System can be conducted either directly out of the boat, via the outlet pipe, or, diverted into the Exhaust Pipe. By utilizing the water in this manner the exhaust pipe is cooled, and in addition an adequate muffling of explosion reports originating from the Compression Chamber, is attained. For this reason, a silencer is not included in

the standard equipment of the engine.

The exhaust pipe can, in most cases, be laid longitudinally under the deck boards, to where it is led out under the stern counter, and it must be as straight as possible, and free from sharp bends.

The outlet pipe from the turn cock is curved down alongside the exhaust manifold, along the deck, and up the bulwark to its point of outflow, which should be approx. 12 - 14 inches above the water line. A drain cock is installed at the lowest point of the pipe for use in the prevention of frost damage.

The turn cock is (as mentioned above) installed for the sole purpose of controlling the dispersal of the water, either into the discharge pipe, or, the exhaust pipe. Therefore, it is important to ensure that water is not flowing into the latter, when the engine is stopped, or the heated metal will produce water evaporation, and the resulting steam, penetrating into the engine, will cause rust corrosion on the valves, etc.

Therefore, the water should be directed into the outlet pipe, when the engine is started, and then diverted into the exhaust pipe when the boat is under way. Conversely, the flow should be re-directed from the exhaust pipe, into the outlet pipe, a short time before intending to stop the engine, the latter being run at full revolutions about 30 seconds, as this has proved to be the most efficacious means of dispersing the remaining water from the exhaust pipe.

If the above method of exhaust cooling is not desired, then an additional outer pipe should be constructed, so as to enclose the actual exhaust pipe. The water will then circulate around the latter, and will eliminate the danger of fire. This is always a serious possibility, if a boat is driven for any considerable period with no means of cooling the exhaust pipe, as the woodwork will scorch and smoulder until there is a risk of the boat being destroyed.

It should be noted that a silencer will be necessary, if an additional conduit is employed, as described above.

The deck casing for the engine must be of solid construction, waterproof, and easily removable. The latter requirement can be fulfilled by the following method: - The rear wall of the casing should be firmly secured to the deck as a permanent fixture, and the two sides, and the front wall, (being constructed in one section in U-form) can then be fastened to it by means of hooks. Thus the front section can be easily withdrawn from around the engine whenever that is necessary. The controls for regulating the carburettor damper valve, and the ignition should be fastened on the outside of the rear wall, and thus it will not be necessary to disconnect the control rods to the carburettor and the magneto when the front section of the casing is to be removed.

INITIAL RUNNING.

When the installation of the engine has been fully completed, and it is ready for running in, the following points should be

noted:

Ensure that the bilge cock is open, so that a free flow of water to the Cooling System is assured, and when the engine has been started ensure that the waste water is being discharged through the outlet pipe, leading from the turn cock. It is always important to check this, as there can be a possibility of a leaky packing, which will enable air to be drawn into the pump, and this would obviously cause the engine to become quickly overheated. If the water is being steadily discharged then the Cooling System is operating satisfactorily.

Although it is self evident that the Flywheel must be fastened securely to the crankshaft, this point should be checked again before the engine is started, as a loose flywheel will immediately set up "knocking" in the engine, and this can be difficult to locate.

Every engine contains the full and correct supply of lubricating oil in the crankcase when despatched from the Factory, but nevertheless, this point should be checked, by ensuring that the oil level is recorded between the two marks on the gauge rod. A refilling plug is situated on top of the frame of the Rear Overhead Starting Crank.

It is most essential to ensure that the Reverse bearing, tube bearing and the bearing in the rear edge of the Clutch, are carefully greased on commencement of the "running in" period, and the three grease cups should be screwed down a little, prior to each period of running. Always ensure that there is a tightly closed container of good quality, non acid grease aboard the boat.

When starting, the engine should be choked one or two times in order to produce a rich mixture in the cylinder. The air intake should be almost fully open, but as soon as the engine has started it should be throttled down, because if the air intake is opened excessively when the propeller is disengaged the engine will "race". This is undesirable and should be avoided.

If an engine is equipped with a Clutch and Reverse Apparatus, it will often be found that when the Reverse lever is put fully forward the full pitch of the propeller blades will consequently be too heavy for the engines power capacity. In that case the pitch must be adjusted, so that the engine runs at a full speed of 1100 - 1300 RPM. The engine should not be run at more than three quarters of the full speed during the running in period, and no attempt must be made to alter the setting of the full and low speed jets on the carburettor as these have been correctly adjusted at the Factory during the engines Test Trials.

N O R M A L R U N N I N G .

The engine can be considered to have been run in sufficiently after a duration of approx. 40 hours, and it can then be run at full speed whenever and for as long as desired, although racing the engine should be avoided.

If the engine is equipped with Reverse apparatus it is important, (as mentioned in the preceding section) to ensure that the propeller blades are correctly pitched, and the engine revolutions

should not exceed 1100 - 1300 RPM. These should be checked with a tachometer, although the beat of the engine will soon prove a sure indication of correct or incorrect pitch.

When in shallow water, and in the vicinity of flotsam, drift-wood, rocks, etc., extreme care should be taken in regard to the propeller blades as they can be easily bent, or broken, when in contact with such obstruction. It is advisable to have full control of the Clutch lever in the above circumstances, so that if necessary, the propeller can be disengaged immediately.

The following procedure should be adopted when taking the boat into a mooring, or quay: - the engine should be throttled down to a suitable low speed when approx. 70 - 80 yards distant from the objective, and the propeller put into full reverse when the distance has decreased (depending upon such factors as wind, currents and tonnage), to approx. 30 yards. The propeller should be re-engaged when the boat has approached to within ten to five yards, and the resultant backing will entirely check the forward speed. This instruction, and the same distance of ten to five yards for checking the speed, will also apply to an engine equipped with Gear.

C A R E O F T H E E N G I N E .

Efficient ignition is a primary requirement for the satisfactory performance of a petrol engine, and the magneto must always be kept dry. (Refer to the sections Magneto and Electrical Equipment.)

The petrol supply must also be in good order, and the petrol pipe should be blown through, and cleaned periodically.

The carburettor should be clean, and as after a time, a little water will always collect in the Float Chamber, (and also in the petrol tank itself) both should be drained from time to time, to avoid engine stoppages.

Difficulties with the engine will also be normally avoided if the circulation of the Cooling System is regularly checked, and correct lubrication is of the greatest importance. (Refer to the Section: Lubrication.)

The engine should always be in a clean condition, and any rust should be scraped off, and the affected section repainted with heat resisting paint.

After a time the engine may become loose on its foundation, owing to vibration, and this point should be checked. The Flywheel should also be checked at regular intervals to ensure that it is firmly secured to its Shaft.

The repair and overhaul of the engine should always be undertaken by a skilled mechanic, and it will always pay to have this done at a qualified workshop, or alternatively, to return the engine to the Manufacturers. "MARNA"s Agents can generally supply Spare Parts, and substitutes for the authorised components should not be used.

The Cylinder Head should be removed, and the Piston, etc. decarbonised when this is thought to be necessary, e. g. after a considerable period of use. The valve clearances should also be checked, and the suitable clearance is 0,4 m/m. This clearance is necessary as the valves become warmer than the cylinder, and expand when the engine is running. Therefore if there is no allowance for clearance the valves will leak and become burnt, thus causing stoppage.

We recommend that this work should be carried out at a workshop, (if the special tools required are not available,) or if the valve adjustment proves to be difficult.

STARTING DIFFICULTIES.

Starting difficulties can usually be traced to faulty ignition, or an obstructed petrol supply. When cold, the engine should normally start after the carburettor has been choked, although it may be advantageous to prime the engine with a little petrol sufficient for it to run for one or two revolutions.

If starting continues to be difficult after this, and providing there is good compression, the ignition should be checked. The spark plug should be removed, and the strength of the spark tested, by putting it in contact with the Cylinder Head while the engine is turned once or twice. If the spark is weak, this can quite often be remedied. (Refer to Section: Magneto).

The engine can sometimes be turned without resistance and if this occurs the valves may be sticking, due to dirt, etc. lying in the valve seat. This can often be remedied by inserting a screwdriver into the valvespring, and pressing it upward, then releasing it suddenly. This ought to clear the obstruction, but before doing this ensure that the valve is right down, that is to say, the valve pusher is in its lowest position.

If the engine starts and then stops again, the fault is nearly always due to failure of the supply, and the pipe from the tank to the carburettor must be checked for possible obstructions. The carburettor must also be checked. (Refer to Section: Carburettor.)

Another reason for this type of stoppage can be an over supply of petrol which can soak the plug. This must be removed and dried, and while the petrol supply is turned off, the engine should be turned over several times. It can be necessary, during cold weather, to choke the carburettor for a short time until the engine becomes warm.

FROST PRECAUTIONS.

Frosty weather is in no way detrimental to the normal running of the engine, providing the following precautions are carried out:

THE COOLING SYSTEM MUST BE DRAINED WHENEVER THE ENGINE IS NOT IN USE, AND THIS SHOULD BE DONE WHEN THE ENGINE IS STILL WARM. It is important to remember that if water remains in the pipe and water packet it will freeze and expand, thereby ruining the Cylinder Block and Cylinder Head which are both expensive to replace.

When the engine has been stopped the drain tap on the Cylinder Block and Exhaust Manifold must be opened two or three turns, so that the flow can be clearly seen. The tap on the pump, and on the discharge pipe should also be opened, providing that the latter is so fitted that it cannot be self drained, and the bilge cock should be closed. Ensure that all these taps are opened when the engine is started again, and check that the water from the engine is being discharged satisfactorily, because if the discharge pipe has frozen, the pressure from the pump can burst the coupling which connects the pump shaft with the driving shaft.

It is obviously more difficult to start the engine during cold and frosty weather, as the oil is congealed, and the bearings work sluggishly. Therefore, extra choking and priming are necessary. It should be remembered that the engine's normal temperature is 65° C., and thus it is expedient to raise it's temperature as soon as possible.

An engine always wears more when it is run for many short periods, (with sufficient intervals for it to become cold) than when it is run for long periods at its correct temperature.

C O O L I N G S Y S T E M.

As the "MARNA" 24-32 HP. is a heat engine, it is obvious that it becomes hot when running, and the correct temperature, after a reasonable period of running is approx. 65° C. or when the hand cannot be held with comfort on the Crankcase. It is important therefore, to realize that engine wear is due more to a low temperature, than to a high one, and that a high grade oil will not be affected unless the engine's temperature clearly rises above 100° C.

The pump is mounted on a bracket, and the shaft is coupled to the driving shaft by means of a rectangular piece of metal, which fits into a slot on each of the above mentioned shafts. This coupling has been purposely weakened by being bored, so that in the event of the engine being turned when the pump is frozen, this coupling will give way, thus preventing the cogs in the pump from being broken, and the pump being severely damaged.

A spare coupling piece is delivered with every engine.

The water is driven from the pump into the Exhaust Manifold, from where it enters and circulates the Cylinder and Cylinder Head, and is finally dispersed, via the turncock, either directly out of the boat through the discharge pipe, or through the exhaust pipe, as described under the Section: Installation.

ALWAYS ENSURE THAT THE WATER IS DIVERTED FROM THE EXHAUST PIPE INTO THE DISCHARGE PIPE, A SHORT TIME PRIOR TO STOPPING THE ENGINE, thereby avoiding difficulties with the valves, which is the reason why the turncock has been designed, and fitted to the engine.

IF THE ENGINE IS USED DURING FROSTY WEATHER THE WATER MUST BE DRAINED, and the pump is equipped with a drain tap.

Lubrication is by means of a grease cup, situated on the pump, and this cup should be refilled with grease when it has been screwed down to its limit.

Always ensure that the intake pipe is connected tightly to the bilge cock, in order to prevent air penetration, as the latter can cause pump failure.

B I L G E P U M P .

The "MARNA" 24-32 HP. engine can be equipped with a bilge pump, with a capacity of approx. 30 litres per minute, or a bilge pump, with a capacity of approx. 100 litres per minute. In a net fishing boat (dorry-boat) the pump with capacity 100 litres is usually used.

The pumps are mounted on a casing over the flywheel and are driven by means of a V Belt. Engaging and disengaging of the pumps are done by means of an adjusting rod.

An engine which has been equipped with a flywheel casing for the purpose of mounting a dynamo and starter, can also be equipped with a bilge pump.

The bilge pump is working by means of cogwheels.

WHEN THE PUMP IS IN USE IT MUST BE GREASED DAILY.

The V Belt should not be tightened unduly when starting the pump, as overtightening will only cause the pump bearing to wear in proportion.

The water must be drained from the pump during frosty weather.

M A I N T E N A N C E .

Careful and regular maintenance will always pay good dividends, as it will prolong the life of the engine, and will help in avoiding annoyances such as engine stoppages, and the unnecessary purchase of spare parts. Prevent rust on the iron parts, check the foundation and the propeller shaft regularly. Clean the engine at frequent intervals, and if the engine is dismantled the components must be conscientiously and accurately reassembled. However, maintenance is first and foremost a matter of correct lubrication.

W I N T E R S T O R A G E .

If the boat is to be laid up ashore, during the winter months, there is one particular point to be observed, for even if the boat is to be stored in a boat house, the magneto should be removed, and kept in a dry place.

IT IS OBVIOUS THAT ALL THE WATER MUST BE DRAINED FROM THE ENGINE, AND IN EVERY CIRCUMSTANCE IT IS ESSENTIAL THAT THIS IS COMPLIED WITH.

It will be advantageous to pour oil into the water jacket of the Cylinder Block, after the water has been drained, to prevent

the formation of rust, and if the engine is to stand in a damp exposed place, it should be packed with dry cloth, for the same reason.

Before the engine is brought into service again, it should be cleaned internally and externally- and any rust which may have formed, should be scraped off, the affected portions being repainted with a heat resisting paint.

The Crankcase and Clutch must be refilled with fresh oil, and all the grease cups refilled with new good quality grease. The axis of alignment of the engine and propeller shaft must be checked, as the foundation may have warped during the course of the winter.

The petrol supply pipe, and the carburettor, must also be cleaned, as must the boat's water intake filter, and the intake for the Cooling system.

L U B R I C A T I O N .

The life of an engine is entirely dependent on correct lubrication, and only the highest quality lubricating oil should be used for this purpose. Mobiloil A. SAE 30 should be used during the summer, and Mobiloil Arctic in winter.

The engine is lubricated by the so called Circulation System, that is to say, oil is distributed to all vital bearings, etc., by means of a pump, which is situated on the external gear casing.

The cylinder and pistons are lubricated by oil being forced from the Crankshaft bearing into the Crankshaft, then out through the Crank bearing by means of a small hole, which is bored in the lowest part of the connecting Rod. Thus, a little oil is sprayed through this hole on to the cylinder walls, with each revolution.

The oil pump is a gear type, fitted with a tempered cog wheel, and it should not normally require inspection.

The oil passes from the pump to an overflow valve, which controls the oil pressure, and this can be seen when the cover nut on the valve is unscrewed. The pressure rises when this adjusting screw is tightened, and falls when it is slackened.

A tube leads from the pump to the manometer, which indicates whether the engine is being lubricated or not, and the suitable pressure at full speed is approx. 2 kg.

The pressure will decrease when the engine is running at minimum speed, but always ensure that a certain amount is being recorded, and if the pressure falls to 0, the engine must be stopped immediately, and examined.

The engine must also be stopped if an abnormally high pressure is recorded, and the oil pipe should be examined, as it is possible that the high pressure has been caused by the filter having become clogged.

The engine is equipped with an oil gauge rod, situated on the port side, and this should be checked regularly, to ensure that the oil level in the crankcase remains constant, between the two marks on the rod.

Attention should also be given to the fact that surplus oil can be detrimental, as this can cause overheating.

It is essential that the engine receives approx. 7 litres of oil, and when the engine is new this should be changed after the consumption of 150 litres of petrol.

The oil can then be eventually changed after every 400 litres of petrol have been consumed but during the running in period approx. 1/2 litre of oil should be refilled after the consumption of each 60 litres of petrol.

The pump is supplied with oil via a strainer situated in the crankcase sump, and it is then passed on from the pump to the filter on the frame of the Overhead Starting Assembly.

This filter must be cleaned and washed with petrol regularly, at least two to four times a year depending on how much the engine is used, and it can be taken out for this purpose.

The cover nut should be unscrewed, and the filter can then be withdrawn with the cover.

Ensure that the oil is drained from the filter before it is removed, and this can be done by means of the drain tap, which is fitted to the lowest part of the filter pipe.

When the engine oil is to be changed, the engine should be run until it is warm, and then the oil withdrawn by means of the hand suction pump, provided for this purpose.

After as much oil as possible has been pumped out, the engine should be run for a few seconds at minimum speed to ensure that all the oil is removed from the Oil Pump and the filter.

The Crankcase is refilled by pouring oil into the filter plug-hole on the frame of the Overhead starting Assembly.

The cover on the crankcase should be removed periodically and the sludge, which always collects in the sump after a time, should be cleaned out with a cloth.

The oil strainer in the sump should also be cleaned.

The oil should be changed as quickly as possible in the event of the engine being flooded by high waves, or heavy rain, etc., and care should be taken to ensure that no water remains in the engine.

When the crankcase has been refilled with new oil, the engine should be immediately run for a short time, to prevent rust corrosion on the vital parts. The oil in the Clutch is the same as that which is in the engine.

The grease cups on the neck journal of the Clutch, (or Gear) on the Reverse Apparatus, and on the Shaft tube, and water pump should be screwed down a little daily, and it must be remembered that the propeller head on a variable pitch propeller must be filled regularly with grease, at least twice a year, if the boat is used all through the year.

USE OF AN ALTERNATIVE FUEL TO PETROL.

The Marna engine is constructed to operate on petrol fuel, and **other fuels** will never give the same satisfactory result. However, if circumstances necessitate the use of a substitute for petrol, the following procedure should be adopted:

The best substitute fuel is a mixture of White Spirit and 1/20 Lubricating Oil. Tractor petrol can also be used. There are certain disadvantages in the use of these fuels, i. e. the engine will be unable to run with advanced ignition, as this will cause knock.

The engine must be started on petrol, before the other fuel can be used, two fuel tanks, or a twin tank, must be fitted. The switch over of the two fuels should take place when the engine is sufficiently warm after starting. This procedure must be reversed, before the engine is stopped, so as to ensure that the supply pipe and the carburettor only contain petrol.

The lower calorific value of substitute fuels is another rather dangerous disadvantage, as this factor is responsible for combustion. Thus the fuel can easily penetrate between the piston and the cylinder lining to the Crankcase, where it blends with the oil.

For this reason, it should be an invariable rule to check the quality of this oil very carefully, as the engine can wear out in a remarkably short time, if not being correctly lubricated.

Every Marna owner who uses an alternative fuel to petrol, must inevitably reckon on heavier engine wear.

CARBURETTOR.

The majority of the "MARNA" 24-32 HP. engines are now equipped with the 30 millimetre "Simplex" vertical carburettor, which is, in our opinion ideally suitable for the engine, and it was selected after extensive experimental work. In addition, this carburettor is manufactured in Norway, and therefore there is always an adequate supply of spare parts in stock.

The air intake of this carburettor has been adapted for the fittings of an air filter, and this is constructed so that the oil gas, which occurs in the valve cover, is absorbed into the engine.

OPERATION.

The petrol supply pipe is connected to the swivel (N) which can be turned in any direction required, by loosening the screw (K)

and this screw must also be loosened if the filter (which the petrol must pass) and which is situated in N, is to be removed for cleaning.

The carburettor is equipped with two adjustable jets for regulating the quantity of petrol, and full speed is obtained by the adjustment of jet A, while jet B regulates the quantity of petrol required for low speed. The jets are correctly adjusted when the carburettor is despatched from the Factory, but if further adjustment is necessary the following directions should be followed:

JET A. FOR FULL SPEED RUNNING.

To adjust this, open the screw A approx. 1 - 1.1/2 turns, or so much that it is certain that there is enough petrol to enable the engine to start. When the engine has become normally warm, the screw should be tightened until the revolutions decrease, or also when there is banging report from the carburettor. This is a sure indication that the engine requires more petrol, and the screw A must be opened again gradually until a satisfactory result is attained.

JET B. FOR LOW SPEED RUNNING.

The adjustment of this jet is entirely opposite to that required for jet A, as the maximum amount of petrol is supplied from B, when the screw B is fully screwed down.

This screw should be opened a little, so that less petrol is supplied to the engine, and the speed of the latter can be regulated by adjusting screw E, until a satisfactory rate of revolutions has been achieved.

The correct quantity of petrol which should be supplied by the jet can also be gauged by careful listening, and as a rule this amount can be obtained by opening screw B approx. a quarter of a turn from its fully screwed down position.

Any water which may have mixed with the petrol will settle at the bottom of the carburettor, from where it can be removed by means of the drain tap.

The opening or closing of the air damper D regulates the engine running, and if, when starting, it is necessary for the engine to be choked, the damper must be closed, and the engine turned over once or twice.

- A. Full speed nozzle.
- B. Idling nozzle.
- D. Air Damper.
- E. Adjusting Screw for Air Damper
- F. Choke for Starting.
- H. Float Valve.

L I S T O F C O M P O N E N T P A R T S .

- 00 Carburettor Body. Lower Section.
- 01 - " - " Upper Section.
- 02 Swivel Union. For 1/4" or 5/16" flanged pipe.

- 03 Base Screw.
- 04 Strainer.
- 05 Nut for flanged pipe (for 1/4" or 5/16" pipe)
- 06 Upper Packing for Swivel Union.
- 07 Lower " " " " "
- 08 Seat for Float Needle.
- 09 Cover. Cover Complete. (09 - 13 - 14 - 15 - 16).
- 10 Cover Spring Clip.
- 11 Ball Grip.
- 12 Float.
- 13 Float Needle.
- 14 Roller.
- 15 Plummet.
- 16 Clamp.
- 17 Main Nozzle. (Main Nozzle Complete. 17 - 18 - 19 - 20).
- 18 Nozzle Needle.
- 19 Regulating Screw for Needle.
- 20 Spring.
- 21 Idling Nozzle. (Idling Nozzle Complete 21 - 22 - 23).
- 22 Regulating Screw.
- 23 Spring.
- 24 Screw with seat for Nozzle.
- 25 Petrol pipe.
- 26 Packing for petrol pipe.
- 27 Choke Bush. 26 m/m. 14 - 15 - 16 - 17 internal dia.
- 27 " " 30 m/m. 18 - 19 - 20 - 21 - 33 internal dia.
- 28 Spindle for Choke Damper.
- 29 Choke Damper.
- 30 Lever for mixture and Choke Damper Complete (30 & 47).
- 31 Spring for Choke Damper.
- 32 Impact Stud.
- 33 Stud for Choke Spindle.
- 34 Spindle for mixture damper.
- 35 Mixture Damper.
- 36 Impact Back Square.
- 37 Stop Ring.
- 40 Plug for Float Chamber.
- 41 Double tightening cone.
- 42 Plug for Petrol pipe.
- 43 Screw for Choke Damper Stop.
- 44 " " Mixture and Choke Damper.
- 45 " " securing the Choke Damper.
- 46 Suction Pipe.
- 47 Screw in Lever (30).
- 48 " with nut for idling adjustment.
- 49 " for securing Body. Upper Section (01).
- 50 " " cover spring clip.
- 51 Nut for Part 50.
- 52 Stud for Impact Back Square (36).
- 53 Tightening screw, in channel for idling power petrol.
- 021 Swivel Union. For 1/4" or 5/16" pipe with double tightening cone.
- 051 Nut for 1/4" or 5/16" pipe with double tightening cone.

WHEN ORDERING THE CHOKE BUSH PLEASE STATE THE INTERNAL AND EXTERNAL DIAMETER REQUIRED.

M A G N E T O.

The "MARNA" engine is equipped with a High Tension magneto with impulse coupling, and sparking plugs of a suitable heat value should be used in conjunction, as a strong spark discharge is of vital importance for the ensured running of the engine. The various plug manufacturers employ different terms for the heat value of their products, but generally speaking, the plugs must be of a comparative heat, and the suitable distance between the electrodes is 0,7 millimetres.

It is possible that the lead from the magneto to the plug may become cracked after the engine has undergone a period of use, and in this event the lead should be checked to ensure that good insulation is retained so that the current is not short circuited.

The firing order for the cylinders is in the following sequence, 1 - 2 - 4 - 3, as viewed from the front of the engine.

The plug protectors should be examined in the event of their becoming loose, to ensure that they are firmly attached to their respective leads, and the latter are connected to the magneto by means of a cable shoe, soldered to the appropriate end. This should be firmly inserted into the output point on the distributor cover, and enclosed by the rubber insulator, which must be in place. If the cable shoe becomes damaged a replacement should be soldered to the lead.

If the exterior of the distributor cover becomes damp there is always a possibility of the spark returning direct to the magneto from the lead outlet, thus causing a short circuit. This can be remedied by drying the cover thoroughly.

The magneto is solidly secured, but in a manner which facilitates removal, it being only necessary to slacken the lock nut on the under side of the magneto bracket and the retaining clamp band can be unscrewed. The bracket itself is designed to obviate the possibility of the magneto being replaced at an oblique angle, but if the magneto is removed the connecting drivers on the magneto, and magneto drive shaft should be marked, prior to removal, so that there will be certainty of correct re-connection.

In the event of magneto failure, the platinum pins, (which can be seen when the lower end cover of the magneto is removed) should be examined to ascertain if they are burnt, and if that is the case, they should be cleaned with a fine file, such as a nail file, with a resulting clearance of approx. 0,3 millimeters. The lead should also be examined for possible faults, but if neither that, nor the pins, appear to give cause for the unsatisfactory working of the magneto, the latter should be returned to the supplier, or sent to a reputable workshop to be overhauled, as no further self repairs should be attempted.

RELIABLE DRY PLUGS SHOULD ALWAYS BE STORED ON BORD FOR AN EMERGENCY.

Starting is facilitated by the magneto impulse, which ensures
17.

a perfect spark discharge from the plug even with the minor revolutions produced by turning the engine by hand. The impulse is automatically disengaged immediately the engine has started.

ADJUSTMENT OF THE TIME OF IGNITION.

Advanced, or preignition is the term given to ignition before compression, that is to say, that the spark discharge at the plug occurs a moment prior to the piston being in Top Dead Centre position. (T.D.C.) Advanced ignition depends on the engine revolutions, - a high number of revolutions demand an increase of advancement, and vice versa. The suitable amount of advanced ignition for the "MARNA" 24-32 HP. engine is 16 degrees at full revolutions, the magneto being adjusted to advanced ignition, and the spark discharge at the plug occurs at the exact moment the pins commence to open.

The procedure for adjusting the correct time of ignition is as follows:

The flywheel should be turned to bring the front piston into accurate Top Dead Centre position, which can be determined by unscrewing the priming cock, and subsequently inserting a length of wire into the cylinder against the upper surface of the piston, thus ascertaining the highest position of the latter.

A mark should then be made at the top centre of the flywheel, as viewed from the front, and a second mark inscribed at a distance of 48 millimetres to the right of the first mark, this being equivalent to 16 degrees of the periphery. Thus, ignition will occur when the second mark is in the uppermost position of the flywheels course, and it is this juncture that the pins commence to open. The magneto is therefore correctly adjusted, and is on advanced ignition.

In the event of the pins not opening at the correct time this can be regulated by means of the adjusting plate which is mounted on the magneto driving shaft. This plate is in two parts and it is possible to turn the outer plate in relation to the inner by means of the appropriate screws. The impulse ignition is adjusted simultaneously with the correct adjustment of the magneto, and the former invariably occurs later than the ordinary time of ignition. The reason for this is to ensure that back stroke is avoided and the impulse will release at 24 degrees retarded ignition when the magneto is set at 16 degrees advanced ignition.

The magneto is equipped with a handle which in addition to the purpose of setting the magneto to pre and retarded ignition also fulfills the function of operating a cut out mechanism. THE CURRENT IS CUT OFF WHEN THE HANDLE IS PRESSED RIGHT UP. Special attention should be given to this point, as many persons have attempted to crank the engine without being aware that the current is cut off when the handle is in the aforementioned position.

When the magneto is adjusted to advanced ignition, that is to say, at 16 degrees prior to Top Dead Centre the handle can be raised a considerable distance, namely 26 degrees, before cut

out is effected, and the engine will then have a time of ignition of 10 degrees above Top Dead Centre, the lowest ignition attainable.

TIGHTENING THE CHAIN.

The chain should be examined after a period of use, to ascertain if it is necessary to re-tighten it. This can be determined by touch, and slackness is indicated if the magneto shaft can be moved forwards and backwards. Therefore, the cover which is located on the rear side of the Rear Overhead Starting Crank frame should be removed, and the nut on the 5/8" bolt, securing the tension wheel, should be loosened just sufficiently to allow a suitable friction on the wheel. The latter can then be regulated by means of an adjusting screw, which is situated on the right side of the starting crank frame. Adequate tension will have been attained when the chain can be barely moved to and fro, although it should be able to be moved approx. 5 millimetres at the point where it is suspended between the magneto shaft and camshaft, in the uppermost section of the frame. This can be verified by inserting a finger, or a length of bent wire into the frame hatch, but the engine must be turned a complete revolution so that the tension can be ascertained at several points of the chain. The tension wheel must be firmly re-secured, and the cover replaced, on the completion of adjustment.

ADJUSTMENT OF THE CAMSHAFT.

In the event of the engine being dismantled, or the camshaft being out of correct position, the method of re-adjusting the shaft is as follows:

Remove the Cylinder Head, magneto bracket, the cover which is removed for the purpose of tightening the chain, and the small cover which is situated on the Starting Crank frame, directly in front of the end of the exhaust manifold. Crank the engine, and ensure that the rear piston is in accurate Top Dead Centre position when the exhaust valve closes. If these do not correspond the camshaft must be readjusted accordingly until the desired result is attained.

There are two points to which attention must be given when adjusting the camshaft, and which are as follows:

Firstly, the Starting Crank must be adjusted so that ignition occurs when the crank is uppermost, that is to say, the rearmost piston is at the highest point when the crank is meshed in top position, and secondly, the chain drive must be adequately loosened and thrust into slack position before the chain can be altered.

When the crankshaft and starting crank are correctly positioned in relation to each other, as described, the camshaft should be turned while the crankshaft and starting crank shaft remain in the aforementioned correct position. A rigid length of wire with a curved end should be used to lift the chain, the wire being inserted through the aperture below the aftermost end of the exhaust manifold. Effort must not be relaxed until

the closing of the rear exhaust valve coincides with the top position of the piston.

When this has been accomplished the magneto must be checked to ensure correct ignition. Particular attention should be given to the fact that the ignition adjusting arm operates an internal ignition cut out switch in the magneto, current to the plugs being cut when the arm is raised to the highest possible extent.

The leads must be replaced in the following order, 1 - 2 - 4 - 3, from the rear cylinder and forward.

R E A R O V E R H E A D S T A R T I N G C R A N K .

The "MARNA" 24-32 HP. engine is equipped with a Rear Overhead Starting Crank to facilitate starting, and the magneto is mounted on the frame of this assembly, in the opposite direction to the crank, so that it is thus situated in the highest and driest possible position in the boat. The crank operates by means of a triplex chain, of 3/8" dimension, and the shaft is constructed, so that the crank can be engaged in two different positions, proportionate to the position of the piston.

When starting, the crank should be engaged in it's lowest position and pulled up and over, as it is incorrect to engage at it's highest point so that it has to be pushed downwards. It should be pressed in a little to engage, so that the crank key can be felt when it makes contact, and the crank will automatically disengage and return to it's stationary position when the engine has started.

The engine's deck casing should preferably be constructed so that only the crank protrudes from the rear, and the crank shaft bearing at the securing end of the crank should be lubricated with a little oil at regular intervals.

T H E C L U T C H .

The function of the clutch is to allow the propeller to be disengaged when the engine is running, and it has a cast iron spring which expands when the control lever is moved into forward position. The spring then grips a bell coupling thus connecting the engine and propeller shafts.

The forward movement of the control lever forces a tapered cylinder to the rear, which allows two arms in the friction spring to bend outwards, and if the clutch becomes slack the adjustable hardened screws situated on these arms must be tightened. This can be done by loosening the lock nuts, and the screws should then be turned in a clockwise direction until a suitable adjustment has been attained, but always ensure that both arms are equally readjusted if their position is altered.

A sliding bearing is situated in the rear of the clutch assembly for the purpose of preventing the penetration of sea water if the deck becomes awash, and the shaft is covered. This bearing must be lubricated daily if it is to fulfil it's purpose.

The grease cup on this bearing should be screwed down a little whenever the engine has finished running, for example in the evening, as this will help to stop the penetration of water in the event of the latter rising over the bearing, and a periodical check should be made to ensure that the clutch assembly contains a satisfactory amount of oil. (Refer to the Section Lubrication.)

If water does happen to penetrate into the clutch assembly and crankcase, they must be drained carefully, and then refilled with clean oil.

The engine should be run as soon as the refilling has been completed, so that all parts are sprayed with clean oil.

The oil which is used in the crankcase and by the clutch is identical.

T H E G E A R .

In addition to operating as a clutch forward running, the "MARNA" gear fulfils the purpose of disengaging the propeller, and of altering the direction of rotation. It is constructed on the Differential Principle, and for forward running it operates approximately the same as a normal clutch. That is to say a cast iron friction spring expands when the gear lever is moved forward, and engages firmly in a bell coupling, thus connecting the engine and propeller shafts.

The forward movement of the gear lever forces a tapered cylinder rearwards which allows two arms in the friction spring to bend outwards, and if the gear coupling becomes slack the adjustable hardened screws situated on these arms must be tightened. This can be done by loosening the lock nuts and the screws should then be turned in a clockwise direction until a suitable adjustment has been attained, but always ensure that both arms are equally readjusted if their position is altered.

When the boat is reversed the gear lever is moved into the rear position and an internal steel bar is drawn back, thereby exerting tension on a cast metal expansion band, which grips the internal gear housing and locks it. Thereafter, and by means of several cog wheels the propeller shaft is driven in counter rotation to the engine shaft.

The steel draw bar is connected to the expansion band by a bolt, one end of which contains a roller, the other being threaded for a nut, and lock nut. The purpose of the roller is to facilitate the rearward movement of the bar, and when that is in position it is retained by the roller engaging in a recess in front of the bar's inclined edge.

It is possible that the front corner of this recess will become worn in the course of time, and the gear will then be unable to function properly. This can be rectified by filing the recess accordingly, and it may also be necessary to adjust the bolt nuts if the gear slips when the boat is being reversed.

The oil which is used to lubricate the cog wheels of the gear originates from the Oil Pump, and is fed through the rear
21.

crank bearing to the crankshaft from where it is passed in the gear assembly. Thus, the oil which lubricates the gear is the same as is used in the engine.

A sliding gearing is situated in the rear of the gear assembly for the purpose of preventing the penetration of sea water, if the deck becomes awash and the shaft is covered.

This bearing must be lubricated daily if it is to fulfil it's purpose, and also when the engine has finished running. If water does happen to penetrate into the gear assembly and crankcase, they must be drained carefully, and then refilled with clean oil. The engine should be run as soon as refilling has been completed, so that all parts are sprayed with clean oil. A large inspection cover is situated on the top of the gear assembly, to facilitate the drainage mentioned above.

R E V E R S E A P P A R A T U S .

The Reverse apparatus for the 24-32 HP. engine can be supplied in three types: A, B and the "MARNA" Screw Reverse, and it consist of the following main parts:

A: Base. B: Bearing Slide. D: Bearing. E: Handle and connecting arm. H: Propeller Tube.

All types are lubricated by means of a grease cup, which must be screwed down a little each day if the engine is in constant use, and which must be refilled when it has been entirely screwed down.

The three types work on a common principle. There is a bored disc (reversingclip) screwed to the tube, and when the control lever is operated, this clip is twisted, thus causing the tube to move longitudinally in relation to the propeller shaft, thereby altering the pitch of the propeller blades. This clip must therefore be screwed firmly to the tube at the point where the propeller attains it's maximum forward and reverse positions.

TYPES A AND B.

These two types are equipped with a handle, with axial movement for attaining the forward, neutral and reverse positions, and type A has been designed so that it can be mounted on the engine's foundation. This fact should therefore be taken into consideration, when deciding the length of the foundation, prior to installation, and a suitable distance at the rear of the engine should be allowed for.

Type B is designed for craft in which the engine is mounted right aft, and also for boats in which a sharply pointed bottom presents difficulty in fitting the more normal type A. But with the exception of this difference in the mounting positions, the two types are similar.

There must be a certain friction between the slide B and the Bearing D in order that the propeller blades maintain the pitch required, and do not, at any time, change position on their own volition. This friction can be adjusted by turning nut K.

It is customary to mount the apparatus so that the forward movement of the control lever accords with the forward movement of the boat, but it can be fitted inversely.

"MARNA" SCREW REVERSE.

This is mounted in the same way as Type A, but the handle has a rotating movement for the three positions and it should be turned approx. 180° from maximum forward to maximum reverse, neutral position being between the two extremes.

The apparatus should be adjusted so that the hand grip points straight ahead, when the apparatus is in max. forward position.

The apparatus is easy to handle, with the additional advantage that a wheel can substitute for the hand grip, so that with the assistance of a chain, wire, etc. control can be established from one's seated position.

The shaft which transfers the turning movement of the handle to the eccentric pulley inside the apparatus is fitted with a stuffing box which serves to prevent penetration of water, and it must be suitable tightened.

There is a possibility that after a period of use, the propeller blades will tend to change their position during speed, and this can be rectified by tightening the stuffing box a little.

FITTING REGULATIONS FOR ALL TYPES.

The apparatus should be carefully directed into position, and bolted to it's foundation. This operation can be done as follows:

The two screws (F) situated on the side of the apparatus should be loosened, until the slide (B) can be moved in relation to the base, and then the slide and bearing (D) will guide themselves in, after the centre of the propeller shaft.

The slider contains recessed sections which allow clearance for the two bolts (F), so that it can rise and fall as the angle with the base changes.

The slide, and the bearing, should be checked, to ensure that they have guided themselves in correctly after the centre of the propeller shaft, and then the bolts can be firmly tightened again. The bearing should then be so fitted, that there is no bend in relation to the shaft.

Such bend may occur later, due to a possible warping of the foundation members, and therefore, (particularly in the case of a newly fitted craft) the two bolts should be slackened again, in order to straighten the bend.

This simple method of rectifying any bend that may occur, is of considerable importance for the life of the propeller tube.

P R O P E L L E R A S S E M B L Y.

The "MARNA" 24-32 HP. 4 cyl. engine, with Clutch Assembly and variable pitch propeller is equipped with a 1" dia. nickel
23.

brass propeller shaft and a 1.1/4" dia. brass draw tube, together with a 1.5/8" dia. bush.

The "MARNA" 24-32 HP. 4 cyl. engine with Gear Assembly and a fixed propeller is equipped with a 1" dia. stainless steel propeller shaft and 1.3/8" bush, or with a 1.1/4" dia. brass shaft and 1.5/8" dia. bush.

In view of the fact that the stern post, and also the foundation members for the engine and reversing assembly are generally constructed of wood, which has a natural tendency to warp when in contact with water, it is important to ensure that the propeller shaft is not affected by the warping action of the timbers. A bent shaft will be subjected to rapid and excessive wear, and therefore a regular examination should be made to ensure that the shaft retains it's original rigidity, and revolves evenly (Refer to the Section: Installation.)

The stern tube is externally and internally sealed with a tallow packing and this should be examined yearly to ensure that tightness is retained, as otherwise, water can penetrate inboard through the defective joint. It is important that, (not only during initial installation, but also during any subsequent replacement of the packing) that neither of the joints are too compact, particularly the internal one, as this will usually result in excessive heat inside the tube.

The reversing tube is also sealed with a tallow joint, which should be inspected, and the propeller head is filled with grease, the latter being replenished by way of the filler hole, situated in the head itself.

P E T R O L T A N K .

A petrol tank is supplied with each engine, also supply pipe from tank to carburettor, and the tank must be fitted so that it is at least 8" above the level of the carburettor, as it must be remembered that the boat rises when under way.

The supply pipe should be laid as straight as possible, as this facilitates cleaning.

If a vacuum occurs in the tank, the petrol will have difficulty in flowing to the carburettor, and a small hole is bored in the lid of the tank, to prevent this contingency. In the case of a tank being situated under the deck, this hole is bored in the connecting pipe, between the tank and the deck screw cap, and care must be taken to ensure that this hole is not filled.

The petrol will often contain a little water, and the latter can also penetrate into the tank through the filler cap, so the tank should be drained at regular intervals. Water is easily drained, as being heavier than petrol it will always collect at the bottom of the tank.

E L E C T R I C A L E Q U I P M E N T .

The "MARNA" 24-32 HP. engine can be fitted with the following equipment:

1. Electric Starter: 12 volt.
Dynamo : 12 volt 75 watt.
- " - : 12 volt 130 watt, which can be supplied
if necessary.

This equipment is supplied together with a 12 volt battery, switch, ammeter and fuse box, - the 75 watt dynamo and battery being sufficient to supply current for the necessary navigational lamps, and also for a certain amount of internal lighting. A boat which is equipped with an echo sounder, etc., requires additional power, and therefore, a 130 watt dynamo is recommended in that case, and the flywheel must be fitted with ring gear.

2. Dynamo: 6 volt with battery, fuse box and ammeter.

In the event of the non-requirement of a starter, and if only lighting current is required, the engine can be supplied with dynamo and battery only.

3. Dynamo: 12 volt, 75 or 130 watt.

As for Number 2 above.

THE DYNAMO.

This is a small, regulated voltage, Direct Current dynamo, and the type which is fitted to the "MARNA" 4 cyl. 24-32 HP. engine operates with a comparative high number of revolutions, this applying to both the 6 and 12 volt types.

These dynamos are always fitted with a voltage regulator which automatically connects or disconnects the supply of current from the dynamo, depending on the high or low number of dynamo revolutions, - connection normally occurring when the engine attains 600 - 700 R.P.M. The dynamo will then commence to supply current to the battery, assuming that the latter is not fully charged. This supply will be increased a little, with an increase of engine revolutions but it will remain tolerably constant whether the engine is running at 800 or 1000 R.P.M. It is known as the charging current, the magnitude of which is indicated by the ammeter, - normal readings for the 6 volt, 75 watt dynamo being approx. 12 - 13 amperes, with approx. 11 amperes for the 12 volt, 130 watt type. The current will decrease when the battery is fully charged.

The voltage regulator on these dynamos are sealed by the Manufacturers. IF THIS SEAL IS BROKEN THE GUARANTEE IS RENDERED INVALID.

Accurate measuring instruments are demanded for the adjustment of the regulator, although it is rare for any trouble to occur, but in the event of the latter the dynamo must be returned to the supplier for examination. A dynamo must always be protected as much as possible against water and damp, and it must also be kept free from oil and dirt.

THE BATTERY.

This is a normal accumulator, and a 6 volt battery must be used in conjunction with a 6 volt dynamo, - a 12 volt type for a 12 volt dynamo.

The battery should be kept in a low wooden box, corresponding to the external dimensions of the battery, the base and sides being lined with lead plates, soldered at the joints, thus making the box completely tight, so that any possible acid overflow will collect in the base, and be prevented from running into the boat. In addition, the battery should be kept in a dry place on board.

The capacity of the battery is measured in ampere hours, (Ah), a suitable capacity being 90 Ah. A battery always requires a little care and attention, and it should be kept as clean and dry as possible. Attention should always be given to the execution of the connection between the poles of the battery and the lead connections, and the terminal clips should be firmly screwed up before connection. The battery poles should be smeared with non-acid vaseline after connection has been effected, to prevent oxidation and resultant poor contact.

Care should be taken to ensure that a battery never short circuits, as such an occurrence can result in the danger of fire.

An acid filled battery must be refilled with distilled water if the liquid level falls below the top of the cells, as the latter must be covered.

ELECTRIC STARTER.

The starters which are fitted to the 4 cyl. 24-32 HP. engine have an electro-magnetic connection from the gear wheel, and the starter switch operates a control current, which consequently operates the electro-magnetic connecting mechanism, thus connecting the starter so that it receives current from the battery. The starter switch can be mounted when it is thought to be most convenient, - in most instances the most natural position being at the side of the throttle lever, on the rear wall of the engine casing.

A large amperage is employed when the engine is started electrically, and therefore the leads between the starter and the battery, and between the battery and engine frame must be as strongly dimensioned as is shown on the Wiring Diagram. The lead from the starter to the battery should not exceed 1,5 metre in length, as a longer distance than this requires a greater transverse section than is indicated by the diagram.

The Wiring Diagram shows the method of connection between dynamo-battery-starter, and, possible lights.

Great attention should be given to ensure that all connections form good contact, - the cable shoe and the battery clamps must be soldered to their respective leads, the soldering being efficiently executed, and the connecting screws and nuts must be firmly screwed. It is however, always a good policy to

entrust the connection of the electrical equipment to a qualified local craftsman.

A D D I T I O N A L E Q U I P M E N T .

The "MARNA" 24-32 HP. engine can be equipped with various additional electrical equipment, as has been previously mentioned under the Section: "Electrical Equipment", and the engine can also be equipped with special equipment which has been designed for use in net boats, such as a coupling bell, with appurtenant components, for the operation of net hauling. The engine is also usually equipped with a bilge pump, with a capacity of 100 litres per minute for use in net boats. A 30 litre per minute bilge pump can also be supplied, which will be extremely suitable for use in light boats, or pleasure boats.

The various additional types of equipment described above can be combined so as to be suitable for the majority of purposes.

O R D E R I N G O F S P A R E P A R T S .

The "MARNA" engine is being continually improved, and therefore, the Manufacturers reserve the right to modify, or vary construction, at any time, without giving prior warning. IT IS THUS ABSOLUTELY ESSENTIAL, THAT THE TYPE AND THE NUMBER OF ENGINE IS GIVEN WHEN SPARE PARTS ARE ORDERED. Noncompliance with this rule will lead to the risk of the receipt of unsuitable components, and delay in despatch.

Each part of the engine has a number. It is not arbitrary, having been built up in a special system, and to ensure convenience in the selection of a required part, these are divided into different groups, which are as follows:

- | | |
|---------------------------------|-----------------------------------|
| 01. Cylinder | 24. Oil Filter |
| 02. Cylinder Head | 25. Hand Pump |
| 03. Piston - Connecting Rod | 30. Magneto |
| 04. Exhaust Manifold | 35. Pump, for Cooling System |
| 05. Turn Cock | 40. Rear Overhead Starting Crank |
| 06. Carburettor | 45. Clutch |
| 10. Crankcase | 46. Reverse Apparatus |
| 11. Crank | 47. Variable Pitch Propeller |
| 12. Timing Shaft | 48. Ferrule |
| 13. Internal Lubrication System | 50. Gear |
| 20. Pinion Casing | 51. Fixed Propeller |
| 21. External Lubrication System | 55. Electrical Starting Equipment |
| 22. Oil Pump | 60. Standard Equipment |
| | 70. Bilge Pump. |

The number of the 24-32 HP. Cylinder Head, for example is 40201, the primary figure 4 being the distinguishing number for all components of the "MARNA" 24-32 HP. type FF engine. Then follows 02, the group number for the Cylinder Head, and finally 01, which is the particular number for the Cylinder Head itself.

Thus, all parts for the Cylinder Head will be numbered 402, followed by two other figures, which decide the particular

part required.

For example, the Sparking Plug is numbered 40240, while the number for the piston is 40310.

Instances will occur when parts do not belong to a precise group, or engine type, such as nuts, bolts, and screws, which have only an ordinary number, for example 108, which is the number for the bolt securing the side cover of the crankcase. In addition, there are a number of standard fittings which are common to all types of Marna engines, - for example, the 1/8" Pipe threaded Drain Cock, which is numbered SF. 60.

The drawing should be studied before a part is ordered, in order to ascertain the required number, and the latter should be checked against the List, then ordered as follows:

For "MARNA" 24-32 HP. FF no. 6745. Year ordered 1952.
One Cylinder Head Gasket No. 40202 A.

A rapid and faultless dispatch can be relied on.

In conclusion, we would mention that in our opinion a Marna purchaser will find it profitable to study and to follow these Instructions as closely as possible.

A Marna engine will give good and faithful service for many years, providing it receives proper care and attention.

P A R T S L I S T.

CYLINDER ASSEMBLY

Group 01

Number	Total	
40101 A	1	Cylinder Block
40102 A	1	Joint
138	9	Hexagonal Nut 1/2"
40103 A	8	Valve Guide
40104 A	8	Valve 40 ϕ x 170 m/m.
40105	8	Valve Spring
40106	8	" " Cup
40107	8	" " " Cotter
40108	1	Chamber Cover
40109	1	Joint for 40108
40110	2	Stud Bolt 3/8" x 115
136	2	Hex. Nut 3/8"
40113	1	Plug 1.1/4" Pipe thread
SF 57	4	" 1" " "
SF 60	1	Drain Cock 1/8" Pipe th.
40116 A	1	Water Nozzle
40118 A	15	Stud Bolt for Cylinder Head
40119	4	" " " Exhaust Manifold
40120	1	Nameplate
198	2	- " - Brass Screws 5/32" x 10 m/m. Round Head
SF 55	2	Plug 3/4" Pipe th.

CYLINDER HEAD ASSEMBLY

Group 02

40201 D	1	Cylinder Head
40202 A	1	- " - " Gasket
138	15	Hex. Nut 1/2"
40203	3	Plug
SF 70	4	Priming Cock 1/4" Pipe th.
40240	4	Sparking Plug 18 M.F.
40215	2	Stud Bolt 5/16" x 63 m/m
135	2	Hex. Nut 5/16"
40216	1	Joint, cock - Cyl. Head
40219	1	Plug 5/8" Pipe th.
SF 82	2	Packing Ring
SF 26	2	Union Nut 5/8"
40220	1	Copper Tube, Cock - Exh. 5/8" x 290 m/m
40218	1	" " Cyl. Head 5/8" x 550 m/m.

CONNECTING ROD AND PISTON ASSEMBLY

Group 03

40301 A	4	Connecting Rod c-c - 244 m/m
40302	8	- " - " Hex. Bolt 7/16" SAE x 1.1/2"
40303	4	Hex. Bolt 7/16" SAE x 1.1/4"
40304	4	Lock Wire No. 15 (1,8 ϕ)
40310	4	Piston 95 ϕ
40311	8	Connecting Rod Bush
40312	4	Gudgeon
40313	12	Compression Ring 95 x 4
40314	4	Oil Scraper Ring 95 x 6

29.

EXHAUST MANIFOLD

Group 04

Number	Total	
40401 C	1	Exhaust Manifold
40402 B	1	- " - " - Joint
138	4	Hex. Nut 1/2"
40413 A	1	Exhaust Pipe Elbow
40404	1	- " - Outlet Joint
177	2	Nutted Bolt 7/16" x 40 m/m
40411	1	Elbow 5/8" x 3/4"
SF 55	2	Plug 3/4" Pipe th.
40418	2	Stud Bolt 5/16" x 1"
40410	1	Plug for wateroutlet
SF 13	1	Water union 5/8" Pipe th.

TURN COCK

Group 05

40510	1	Turn Cock Body
40511	1	Union with seating
40512	1	Spindle
40513	1	Neck Bush
40514	1	Stuffing Box
40515	1	Hand turn Grip
40516	1	Joint for 40514.

CARBURETTOR

Group 06

40601	1	Carburettor, Simplex
40602	1	Joint
SF 60	1	Drain Cock
40603	1	Air Filter
40604	1	Brass Tube 1.5/8" x 35 m/m for Filter
199	1	" Screw 3/16" x 6 m/m.

CRANKCASE

Group 10

41001 A	1	Crankcase
41002	9	Stud Bolt 1/2" x 55
41003	1	Front Crank Bearing Cover
41004	1	Joint for 41003
126	4	Hex. Bolt 7/16" x 1"
130	1	" " 7/16" x 1.3/4"
41005 B	1	Front Crank Bearing
SF 9	1	Union with 5/16" Cone
41006	1	Stuffing Box Cover
41007	1	Joint
108	4	Hex. Bolt 5/16" x 3/4"
41008	1	Square Stuffing Box
41009	1	Joint
109	4	Hex. Bolt 5/16" x 1"
41010	1	Lock Wire
41011	1	Centre Crank Bearing. Top Half
41012	1	" " - " - Bottom Half.

Number	Total	
41013	2	Bolt 5/8" x 55
41014	2	Copper Shim
41015	1	Lock Wire
SF 2	1	Union
41016	1	Front Camshaft Bearing
108	2	Hex. Bolt 5/16" x 3/4"
41017	1	Centre Camshaft Bearing
	1	Screw, Round Head 5/16" x 13 m/m
276	1	Lock Washer 5/16"
41018	1	Rear Camshaft Bearing
109	3	Hex. Bolt 5/16" x 1"
41020	8	Tappet Guide Bush
41021 A	8	Valve Tappet 5/8" x 85
41022	8	Tappet adjusting screw 3/8" SAE x 1"
166	8	Hex. Nut 3/8" x SAE
41023 A	3	Side Cover
41024	3	Joint for 41023 A
108	12	Hex. Bolt 5/16" x 3/4"
41026	1	Gauge Rod (Dipstick) 1/4" x 300
41027	1	Button for Gauge Rod
41028	1	Joint for 41027
41029	2	Foundation Base Plates. Left - Right.
127	2	Hex. Bolt 7/16" x 1.1/4"
129	2	" " 7/16" x 1.1/2"
278	4	Lock Washer 7/16"
41030 A	1	Sump Tray
41031	1	Joint for 41030
108	14	Hex. Bolt 5/16" x 3/4"
SF 6	1	Union 3/8" Pipe th.

CRANKSHAFT

Group 11

41101 B	1	Crankshaft
41102	1	Chain Wheel
41103	1	Key for Chain Wheel 5/16" x 45 m/m
41104	1	Nut " " "
41105	1	Oil Thrower
51110	1	Ball Bearing SKF
41110	1	Flywheel
41114	1	Key 5/16" x 60
41115	1	Hex. Nut 1" Pipe th.

CAMSHAFT

Group 12

41201 B	1	Camshaft
41202	1	- " - Chain Wheel
41203	1	Key 1/4" x 20
41204	1	Washer 1/2"
159	1	Hex. Bolt 1/2" SAE x 1.1/4"

INTERNAL LUBRICATION SYSTEM

Group 13

41330 A	1	Inlet Strainer
41333	1	Strainer Gauze
	2	Wire for Gauze No. 16

Number	Total	
41332	1	Mounting
108	1	Hex. Bolt 5/16" x 3/4"
102	1	" " 1/4" x 1"
134	1	" Nut 1/4"
275	1	Lock Washer 1/4"
41316	1	Quadrangle
SF 6	1	Union 3/8" Pipe th.
41317	1	Nut 3/8" Pipe th.
41318 A	1	Copper Tube 5/16" x 262 Front Crank Bearing
41319 A	1	" " 1/4" x 100 Centre " "
41320 A	1	" " 5/16" x 278 Rear " "
SF 28	4	Union 5/16"
SF 35	4	Olive 5/16"
SF 20	4	Union 1/4"
SF 30	4	Olive 1/4"
41321	1	Quadrangel
41322	1	Union
SF 2	1	" 1/4" Pipe th.
SF 8	1	" 1/4" with 5/16" Cone
41334	1	Plug for strainer.

DRIVE CASING

Group 20

42001 A	1	Drive Casing
42002 A	1	Joint
126	6	Hex. Bolt 7/16" x 1"
42003 B	1	Rear Crank Bearing
212	1	Screw. Round Head 5/16" x 3/4"
276	1	Lock Washer 5/16"
SF 9	1	Union 1/4" Pipe th. with 5/16" Olive
42004	1	Thrust Plate
108	4	Hex. Bolt 5/16" x 3/4"
42005	1	Square Cover
42006	1	Joint for 42005
108	4	Hex. Bolt 5/16" x 3/4"
42007	1	Bearing Cover for Oil Pump
42008	1	Joint for 42007
118	3	Hex. Bolt 3/8" x 1"
42009	1	Bearing Liner for 42007
42010	1	Set Screw
42011	2	Stud Bolt 1/4" x 65 m/m
42030	1	Driving Shaft for Pump
42013	1	Chain Wheel
42014 A	1	Rod 1/4" ϕ
42015	1	3/8" Double Chain, 70 pitches
42016	1	Chain lock for 42015
6204	1	Ball Bearing SKF
42032	1	Bracket for Water Pump
42018	1	Joint for 42032
118	3	Hex. Bolt 3/8" x 1"
MIS 012	1	Oil Ring
42033	1	Intermediate Plate
42034	1	Joint
42035	1	Stuffing Box Plate
207	3	Screw, Round Head 1/4" x 1"
275	3	Lock Washer 1/4"
42031	1	Water Thrower.

GROUP 21

Group 21

Number	Total	
42101	1	Manometer
42102	1	Tightening band, brass.
SF 5	1	Union Sleeve 1/4" Pipe th.
42103	1	Copper Tube 1/4" x 595 m/m, Filter-Manometer
42104	1	" " 3/8" x 285 m/m, Pump -Filter
42105	1	" " 1/2" x 960 m/m, " -Inlet Strainer
42109 A	1	" " 1/4" x 450 m/m, Filter-Magneto Bracket
42110	1	" " 3/8" x 110 m/m, " -Distributer
SF 30	4	Olive 1/4"
SF 20	4	Union Nut 1/4" Pipe th.
SF 33	4	Olive 3/8"
SF 22	4	Union Nut 3/8" Pipe th.
SF 34	2	Olive
SF 25	1	Union Nut, 1/2" Pipe th.
42106	1	Plug 1" Pipe th.
42107	1	Stuffing Box 1/2" Pipe th.
42108	1	Tallow Packing.

OIL PUMP

Group 22

42201 B	1	Pump Body
42202	1	" " Cover
42203	1	Joint
101	4	Hex. Bolt 1/4" x 3/4"
42204	1	Drive Gear
42205	1	Cog Wheel
SF 7	1	Union 3/8" x 1/2" Pipe th.
134	2	Hex. Nut 1/4"
42206	1	Joint (Pump-bracket)
SF 6	1	Union 3/8" Pipe th.

OIL FILTER

Group 24

42401 A	1	Side Cover with base filter
42402	1	Joint
108	4	Hex. Bolt 5/16" x 3/4"
42403 A	1	Oil Filter Tube 3"
42404	1	Tube Packing
42405	1	Filter Cover
42406	1	Joint for 42405
42407	1	Filter Gauze no. 40
	2	Filament Wire
42408	1	Centre Tube 1/2"
42409	1	Base Nut 1/2" Pipe th.
42410	1	Tube 1/4"
SF 6	2	Union 3/8" Pipe th.
SF 2 A	2	" 1/4" " "
SF 50 A	1	Plug 1/8" Pipe th.
42411	1	Overflow valve
42412	1	Steel Ball 3/8"
42413	1	Helical spring
42414	1	Regulating screw
SF 23	1	Base Nut 3/8" Pipe th.
SF 80	1	Joint for nut.

HAND PUMP

Group 25

Number	Total	
42501 A	1	Pump Body
42503	1	Base Valve
	1	Pin 2 x 27
	2	Ball 3/8" stainless
42504 A	1	Pump Body Cover
42505	1	Cover Gland
42506 A	1	Pump Rod
42507	1	Piston Valve
	1	Pin 2 x 12
42508	1	Union for Piston Valve
	1	Screw, Round Head 1/8" x 3/8"
42509	1	Washer (Union-Leathercollar)
42511	1	Leather Collar
108	2	Hex. Bolt 5/16" x 5/8"
42514	1	Copper Tube. Pump - Sump 3/8" x 290 m/m
SF 33	2	Olive 3/8"
SF 22	2	" Nut 3/8"
42515	1	Pump Rod Button.

MAGNETO

Group 30

43001 A	1	Magneto Bracket
43002	1	Packing
117	4	Hex. Bolt 3/8" x 3/4"
43004	1	Bearing Bush 1.3/8" x 61
43005	1	Set Screw 5/16" x 12
43006 B	1	Magneto Drive Spindle
43007 A	1	- " - Chain Wheel
43011	1	Pin 1/4" x 24
43009	1	" 3/16" ϕ for coupling
43010	1	Plug 5/16" for Shaft
43050	1	Magneto
43051	4	Leads
43052	4	Cable Shoe
43053	1	Lead Clamp
201	2	Brass Screw 3/16"
43055	1	Bosch Magneto Coupling
43056	1	Driver Disc
43057	1	Set Plate
	1	Hex. Bolt 3/8" SAE x 3/4"
43058	4	Sparking Plug Protector
43059	4	Rubber Insulator
43021	1	Base
	4	Rivet 3/16" x 14
43022	1	Tightening Screw 7/16" x 40
222	1	Hex. Nut 7/16"
43020 A	1	Brass Band 1 x 25.

PUMP - COOLING SYSTEM

Group 35

43520	1	Body
43521	1	" Cover
43522	1	Packing for Cover
206	6	Brass Screw 1/4" x 3/4"

Number	Total	
43523	1	Driving Shaft
43524	1	" Gear
43525	1	Key for 43523
43526	1	Idler Shaft
43527	1	Driving Gear
43528	1	Stuffing Box
43529	1	Stop Nut
43530	1	Joint
SF 13	2	Union 5/8" Pipe th.
43510	1	Elbow 1/4" Int. and Ex.
SF 90	1	Grease Cup No. 4
43511 B	1	Copper Tube to Exhaust Manifold 5/8" x 565
43564	2	Coupling (brass)
108	4	Hex. Bolt 5/16" x 3/4"
SF 26	2	Box Nut 5/8" Pipe th.
SF 82	2	Packing Ring
SF 60	1	Drain Cock 1/8" Pipe th.

REAR OVERHEAD STARTING CRANK ASSEMBLY

Group 40

44001 B	1	Starting Assembly Frame
44002	1	Packing for 44001 B
118	6	Hex. Bolt 3/8" x 1"
44003	1	Plug with Hex. 1" Pipe th.
44004 A	1	Triples Chain 3/8" x 128 pitches
44005	1	Chain Lock for 44004 A
44017	1	Stud Bolt 5/8" x 100
44018	1	Slide with pin
139	1	Nut 5/8" thread
44019	1	Journal
44020	1	Adjustable Chain Drive
44021	1	Lining for 44020
44022	1	Set Screw 7/16" x 90
137	1	Hex. Nut 7/16"
44023	1	Front Cover
44024	1	Joint for 44023
108	4	Hex. Bolt 5/16" x 3/4"
44011 A	1	Bearing Cover for Magneto Bolt
44012 A	1	Joint for 44011 A
44013 A	1	Lining for 44011 A
44014	1	Set Screw
SF 2	1	Union 1/4"
44015 A	1	Crank Housing
44016	1	Packing
113	4	Hex. Bolt 5/16" x 1.3/4"
44030 A	1	Crank
44033	1	" Claw with shaft
44034 A	1	Pin for Crank 3/8" x 54
121	1	Hex. Nut 3/8" x 3/4"
44035	1	Pin 3/8" x 52

CLUTCH ASSEMBLY

Group 45

44501 B	1	Coupling Box
44502 A	1	Joint for 44501 B

Number	Total	
121	5	Hex. Bolt 3/8" x 1"
44503 A	1	Coupling Bell
44504 A	1	Neck Journal 20 ϕ
44512	1	Coupling
44520 A	1	- " - Shaft
44521	1	- " - Cover
44522	1	- " - " Joint
44523 A	1	Handle
44524	1	Right Packing Washer
44525	1	Packing
44526	1	Left Packing Washer
44527	1	Packing
44528	1	Stud Bolt 3/8" x 40 m/m
136	2	Hex. Nut 3/8"
44540 B	1	Bronze Bearing
44541	1	Packing
118	4	Hex. Bolt 3/8" x 1"
44542 A	1	Stuffing Box
44543	1	Graphited Oil Packing
SF 91	1	Grease Cup No. 6, 1/4" Pipe th.
44548	1	Stop Nut for 44542 A
SF 86	1	Half Bend 1/4" Pipe th. Int. and Ex.
MIM 3047	1	Packing Ring
44545 A	1	Oil Thrower Thrust Plate
193	2	Grub Screw 7/16" x 1"
192	1	" " for Coupling Bell
44552	1	Key 5/16" x 60
44553	1	Friction Spring
44554	1	Key 5/16" x 40
44555	2	Coupling Lever
44556	2	Adjusting Screw 1/2" SAE x 39
168	2	Hex. Nut 1/2" SAE
44557	2	Roller. Coupling Lever
44558	2	Pin for Roller
44559	1	Coupling Cone
44560	1	Half Moon
44561	1	Coupling Fork
44562	2	Screw 1/2" SAE
192	1	Set Screw 7/16" x 3/4"
44563	1	Taper Pin 5/16" thread
135	1	Hex. Nut 5/16" "
108	4	" Bolt 5/16" x 3/4"
44564	1	Key 1/4" x 65 for Coupling
6204	1	SKF radial Ball Bearing 20 ϕ
51106	1	SKF thrust Bearing 47 ϕ x 30 ϕ x 11
192	1	Set Screw 7/16" x 3/4"

REVERSE ASSEMBLY

Group 46

44601	1	Base Type A and B
44602	1	Slide
44603	1	Stud Bolt 7/16" x 92
44604	1	Wheel
44605	1	Galvanised Tube 3/8" x 47
180	2	Nutted Bolt 1/2" x 5"
44606	2	Washer Brass 1/2"
44607	2	Hex. Nut Brass 1/2"

Number	Total	
44608	2	Liner (Clamp Bush for 108)
44609	1	Handle Securing Section
44610	3	Stud Bolt 1/4" Pipe th. Brass
44611	3	Hex. Nut 1/4" Pipe th. Brass
44612	3	" Lock Nut 1/4" Pipe th. Brass
118	3	" Bolt 3/8" x 1"
144	1	" " 3/8" SAE x 1.1/4"
44613	1	" Box Spanner
SF 91	1	Grease Cup 1/4" Pipe th. no. 6
44620	1	Bearing (Lead Bronze) 1.1/4" ϕ
44621	1	Front Piece for Bearing 1.1/4" ϕ
44622	1	Clamp Disc. (Clip) 1.1/4"
44623 A	1	Long Handle
44624	1	Handle Section.

SCREW, REVERSE

44650	1	Base
44651	1	Slide
44652	1	Lower Half Section for 44651
44653	1	Packing
118	4	Hex. Bolt 3/8" x 1"
44654	1	Adjustable Handle Bearing
44655	1	Stop Nut
44656	1	Packing (Hemp)
44657	1	Stuffing Box
44658	1	Handle Column
44659	1	Eccentric for 44658
44664	1	Cone 6,5 x 55 m/m
44660	1	Slide (Square)
44661	1	Arm for Handle Column
139	1	Hex. Nut 5/8"
44662	2	Bush for Securing Screw
181	2	Black Nuted Bolt 1/2" x 6"
44663	2	Washer
SF 91	1	Grease Cup no. 6, 1/4" Pipe th.
44665	1	Bearing (Lead Bronze) 1.1/4"
44666	1	Front Section for Bearing
118	3	Hex. Bolt 3/8" x 1"
44622	1	Clamp Disc (Clip) 1.1/4"
144	1	Hex. Bolt 3/8" SAE x 1.1/4"
44607	2	Nut 1/2" Brass (Substitute for nut on nuted)

VARIABLE PITCH PROPELLER AND SHAFT

Group 47

44701	1	Propeller Head for 1" Shaft and 1.1/4" Tube
44702	1	Tube Head 1.1/4"
44703	2	Hex. Bolt 1/4" Pipe th. for Propeller Head
44704 A	2	Propeller Blades
44705	1	Flange Coupling for shaft 1"
44706	1	Shaft 1" x 2500. Turned, milled and trued complete of nickel manganese bronze
44707	1	Draw Tube 1.1/4" x 2300. Threaded and trued com.
44708	1	Key 1/4"
44709	1	Hex. Nut 3/4"
44710	1	Box Nut for draw Tube
44711	1	Packing for 44710

Number	Total	
44712	1	Plug 1/4" Pipe th. for Propeller Head
44713	1	Pin (Copper Wire)
44714	1	Key for Coupling
192	1	Set Screw 7/16" x 3/4"
173	4	Nutted Bolt 3/8" x 1.3/4"

STERN TUBE ASSEMBLY

Group 48

44820	1	Stern Tube. External 1.1/4" ϕ
44821	1	" " Internal 1.1/4" ϕ
44823	1	Stuffing box for Internal tube
44824	1	- " - " " External "
44814	1	Securing Nut " - " - "
44815	1	- " - " " Internal "
44807	2	Tallow Packing
44822	1	1.5/8" x 675 stern tube
44809	2	Bolt (Tinned) 1/2"
223	2	Hex. Nut 1/2" Brass
	4	Wood Screws 1.1/2" x no. 20. (Internal tube)
SF 5	1	Joining section for grease cup
SF 91	1	Grease Cup no. 6, 1/4" Pipe th.

GEAR ASSEMBLY

Group 50

45001	1	Bearing Liner
45002	1	Bevel Pinion 40 ϕ
45003	1	Key 5/16" x 40 ϕ
45004	1	Bevel Pinion 1" ϕ
45005	1	Key 1/4" x 49
45006	3	Differential Gear
45007	1	Triangle Shaft
45008	1	Gear Case
45009	1	" " Cover
119	6	Hex. Bolt 3/8" x 1.1/4"
45010	1	Iron Wire 1,8 ϕ
45011 A	1	Gear shaft
45012	1	" Cone
45013	1	Key 5/16" for Friction Spring
45016	1	Gear Fork
45017	1	Half Moon
45018	2	Screw 1/2" SAE x 27
192	1	Set Screw 7/16" x 3/4"
45019	1	Taper Pin 5/16" thread
135	1	Hex. Nut 5/16"
45020	1	Gear Box Cover
45021	1	Joint
108	6	Hex. Nut 5/16" x 3/4"
45022	1	Plug 1" Pipe th. Gear Box
45027	1	Flange Coupling 1.1/8" for Gear Shaft
192	1	Set Screw 7/16" x 3/4"
45028	1	Key 1/4" x 65 for coupling
45030 B	1	Gear Box
45031 A	1	Joint
118	5	Hex. Bolt 3/8" x 1"
45040	1	Handle
45041	1	Stop Ring. Left

Number	Total	
45042	1	Stop Ring. Right
45043	1	Stud Bolt 3/8" x 30 m/m
136	2	Hex. Nut 3/8"
45044	2	Packing for Handle
45050	1	Friction Spring
45051	2	Coupling Arm
45052	2	Adjusting Screw 1/2" SAE
168	2	Hex. Nut 1/2" SAE
45053	2	Coupling Arm Roller
45054	2	Pin for roller 10 Ø
45060	1	Brake Ring
45061	1	Guide Screw 3/4" SAE
170	1	Hex. Nut 3/4" SAE
45062	1	Tightening Screw 5/8"
45063	1	Roller for 45062
45064	1	Pin for Roller 8,5 Ø
45065	1	Nut 5/8" for Tightening Screw
45066	1	Splint for 45065 1,8 Ø
45067	1	Slide for Brake Ring
144	1	Hex. Nut 3/8" SAE x 1.1/4"
45068	1	Crown Nut 3/8" SAE
45069	1	Splint 2,5 Ø for 45068
45070 A	1	Bronze Bearing
45071	1	Packing for 45070 A
118	4	Hex. Bolt 3/8" x 1"
45072 A	1	Stuffing Box
45073	1	Graphited Oil Packing
45075	1	Oil Thrower Thrust Plate
51112	1	SKF Thrust Bearing
197	2	Set Screw 5/16" x 1.1/2"
45076	1	Brass Screw 5/16" x 1.1/2" for 45074
MIM 3047	1	Oil Packing Ring 30 Ø
SF 91	1	Grease Cup no. 6, 1/4" Pipe th.
SF 86	1	Galvanised Half Bend 1/4"
45077	1	Thrust Plate
45078	1	Stop Nut for 45072 A.

FIXED PROPELLER

Group 51

45101	1	Propeller
45102	1	Shaft 1.1/4" x 2500. Brass. Turned, milled and trued, complete.
45103	1	Key 1/4" x 60
45104	1	Hex. Nut 1/2" Pipe th.
45105	1	Coupling 1.1/8" Ø
45106	1	Key for 45105
192	1	Set Screw 7/16" x 3/4"
173	4	Nut Bolt 3/8" x 1.1/4"

STERN TUBE ASSEMBLY FOR FIXED PROPELLER

Group 48

44820	1	Stern Tube External 1.1/4" Ø
44821	1	" " Internal 1.1/4" Ø
44823	1	Stuffing Box for Internal tube
44824	1	- " - " " External "
44814	1	Securing Nut " Internal "

Number	Total	
44815	1	Securing Nut for External tube
44807	2	Tallow Packing
44822	1	Stern Tube 1.5/8" x 675
44809	2	" " Bolt 1/2" (Tinned)
223	2	Hex. Nut 1/2" Brass
	4	Wood Screw 1.1/2" no. 20 (Int. Tube)
SF 5	1	Joining Section for Grease Cup
SF 91	1	Grease Cup no. 6, 1/4" Pipe th.

12 VOLT STARTER AND DYNAMO INSTALLATION

Group 55

45530	1	Starter Casing
45531	1	Packing for 45530
126	4	Hex. Bolt 7/16" x 1"
45532	1	Flywheel
45533	1	- " - Ring Gear
45534	1	V Belt Pulley
110	4	Hex. Bolt 5/16" x 1.1/4"
45535	1	Flywheel Casing Cover
45536	1	Joint for 45535
108	6	Hex. Bolt 5/16" x 3/4"
SF 57	1	Plug 1" Pipe th.
45538	1	Dynamo Holder for 12 V.
45539	1	Stop Nut for 45538
45540	1	Clamp Band
45541	1	V Belt Pulley for 12 V.
42 A	1	" "
45543	1	Tightening Screw
45544	1	Washer 3/8"
221	1	Nut 3/8"
118	2	Hex. Bolt 3/8" x 1" for Starter Flange
SF 55	1	Plug 3/4" Pipe th.
45527	1	Bosch Starter EGD 1/12 AL
45594	1	" Dynamo REE 75/12 - 2000 l.
45516	1	Starter Cable 1,5 m. x 4 m/m ²
45517	2	Pole Claw for Battery
45518	1	Cable Shoe
45519	1	Dynamo Lead 2,5 m. x 4 m/m ²
45520 A	1	Start Switch
45521	1	Fuse Box
45522	1	Ammeter
45525	1	Start Switch Lead 2 m. x 2,5 m/m ²
45526	1	Battery 12 Volt.

STANDARD EQUIPMENT

Group 60

CONTROLS:

46050	2	Bush
46051	2	Washer
46053	2	Regulating Rod
SF 40 A	2	Stop Nut
SF 28	2	Packing Nut
46052	2	Graphited Packing
42515	2	Button for 46053
46005	1	Angle Iron for Deck Casing
206	2	Round Headed Brass Screw 1/4" x 3/4"
46006	1	Throttle Button.

Number	Total	
		PETROL TANK:
46010	1	Petrol Tank 50 litre
46011	1	Filling Flange 1" Pipe th.
46012	1	Plug for 46011
46013	1	Union for Cock
SF 60	1	Drain Cock 1/8" Pipe th.
46015	1	Petrol Tank Cock Body
46016	1	Spindle
46017	1	- " - Pin
46018	1	- " - Nut 3/8" Pipe th.
SF 32	1	Olive 5/16" \emptyset
SF 22	1	Union Nut
46020	1	Copper Tube 5/16" x 2500 m/m
	1	Petrol Filter
46021	2	Union with 5/16" Cone, 1/4" x 1/8" Pipe th.
SF 35	2	Double Cone 5/16"
SF 28	2	" " Nut 5/16"
46025	1	Strainer
46026	1	Bilge Intake 3/4"
46027	1	Washer for 46026
SF 44	1	Securing Nut
46028	1	Inlet Cock 3/4"
46029	1	Copper Water Pipe 5/8" x 2500 m/m
SF 27	1	Union Nut 3/4"
SF 83	1	" " Facking 3/4"
SF 26	1	" " 5/8"
SF 82	1	" " Facking 5/8"
	1	Adjustable Spanner 10".

BILGE PUMP

Group 70

47001	1	Pump Body
47002	1	" " Cover
47003	1	Joint
213	8	Screw Round Head 5/16" x 1"
47004	1	Drive Gear for 47005
47005	1	Driving Shaft
47006	1	Key 1/4" x 45
47007	1	Bolt for Drive Gear
47035	1	Drive Gear for 47007
47008	1	Stuffing Box
47009	1	Securing Nut
47010	1	Tallow Packing
47011	1	V Belt Pulley
47012	1	Key 1/4" x 25
47013	1	Hex. Nut 1/2" Pipe th.
47014	2	Hose Coupling 1.1/4"
SF 60	1	Drain Cock 1/8" Pipe th.
SF 90	1	Grease Cup no. 4
117	2	Set Screw 3/8" x 3/4"
47015	1	Strainer with hose coupling 1.1/4"
	1	Rubber Hose 1.1/4"
	3	Hose Clip
47030	1	Lock Bolt 7/16" x 1.1/4"
293	1	Wing Nut 7/16".

EQUIPMENT FOR FRONT FRICTION COUPLING

Number	Total	
47016	1	Coupling Bell
47017 A	1	V Belt Pulley
47018	4	Stud Bolt 1/2"
279	4	Lock Washer 1/2"
138	4	Hex. Nut 1/2"

EQUIPMENT FOR FRONT CLUTCH COUPLING

47025	1	Coupling Bell
47017 A	1	V Belt Pulley
47026	4	Stud Bolt 1/2"
138	4	Hex. Nut 1/2"
279	4	Lock Washer 1/2"
47024	1	Coupling Bell. Manufactured specially for Méssrs. Brödrene Kjøpstad
47024 A	1	Coupling Bell
47040	4	Stud Bolt 1/2" Manufactured specially for Messrs. Leirvik Sveis.

EQUIPMENT FOR NET FISHING BOAT WITH 12 V. DYNAMO

Group 70

41110 A	1	Flywheel
47016	1	Coupling Bell
47018	4	Stud Bolt 1/2"
138	4	Hex. Nut 1/2"
279	4	Lock Washer 1/2"
45562	1	V Belt Pulley (double)
42 B	1	V Belt
47019 B	1	Flywheel Casing
126	4	Hex. Bolt 7/16" x 1"
47027	1	Front Bearing for Pump Bolt
47028	1	Rear - " - " " "
47020 A	1	Bolt for Pump
117	1	Hex. Bolt 3/8" x 3/4"
47021 A	1	Tightening Bar
172	1	Nutted Bolt 3/8" x 1.1/2"
47023	2	Stud Bolt 5/16" x 40 m/m
45589	1	Dynamo Holder for RKC 130/12/825.1.
45539	1	Stop Nut for Holder
45571	1	Clamp Band for RKC 130/12/825.1.
45543	1	Tightening Screw for 45571
221	1	Nut 3/8"
45544	1	Washer 3/8"
45590	1	V Belt Pulley for RKC 130/12/825.1.
42 A	1	V Belt
47035 A	1	Belt Case
114	3	Hex. Bolt 5/16" x 2"
45517	2	Pole Claw for Battery
45518	1	Cable Shoe
45521	1	Fuse Box
45519	1	Dynamo Lead 2,5 m. x 4 m/m ²
45522	1	Ammeter
45526	1	Battery 12 Volt
45529	1	Dynamo RKC 130/12/825.1.

